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| (60) Parent Application or Grant<br>MEDITECH INFORMATION SYSTEMS, LTD. [/];<br>( ). KLEIN, Edward, E. [/]; ( ). RZUCIDLO, Eugene, C. : ( ).  |                  |   |
| (54) Title: METHOD, DEVICE AND SYSTEM FOR FACILITATING ENTRY AND UPDATE OF MULTI-SOURCE MEDICAL INFORMATION  |                  |   |
| (54) Titre: PROCEDE, DISPOSITIF, ET SYSTEME POUR FACILITER L'ENTREE ET LA MISE A JOUR D'INFORMATIONS MEDICALES MULTISOURCES  |                  |   |
| (57) Abstract  |                  |   |
| <p>The present invention provides a system for updating multi-source medical information on a medical information unit immediately upon a patient's receiving medical service. The system typically includes a plurality of medical information units (308), one per patient, each medical information unit configured to identify a patient and to include at least certain medical information; a plurality of portable patient I/O units, each co-located with the patient (302); and a central database having an interface with the portable patient reader/writer units and a plurality of medical input databases (104-112).</p>  |                  |   |
| (57) Abrégé  |                  |   |
| <p>La présente invention concerne un système permettant de mettre à jour, sur une unité d'informations médicales, des informations médicales multisources, et ce juste au moment où un patient reçoit des soins médicaux. Ce système comprend généralement: plusieurs unités d'informations médicales (308), à savoir une par patient, chacune de ces unités étant configurée pour identifier un patient et pour contenir certaines informations médicales; une pluralité d'unités E/S portables, situées au même endroit que les patients (302); et une base de données centrale assurant l'interface avec les unités de lecture/écriture portables des patients et avec une pluralité de bases de données de saisie médicales (104-112).</p> |                  |   |

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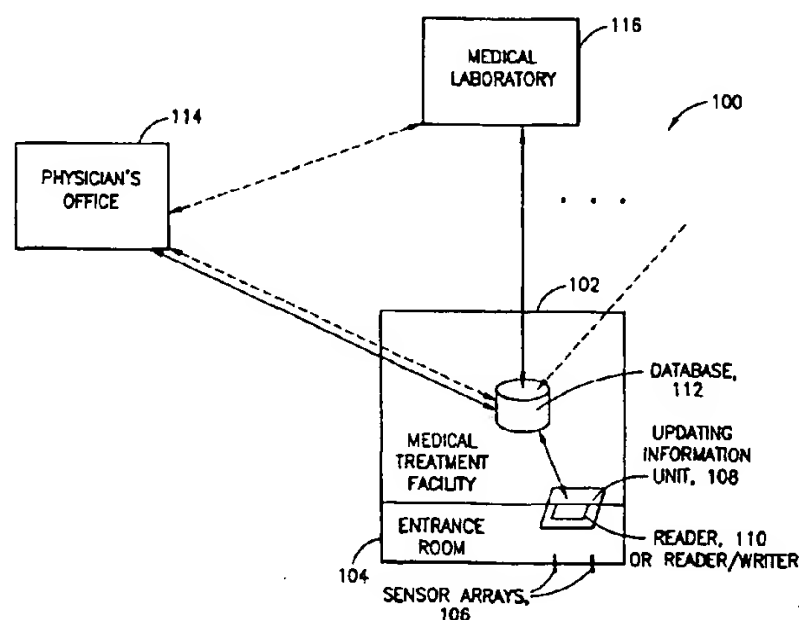
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(54) Title: METHOD, DEVICE AND SYSTEM FOR FACILITATING ENTRY AND UPDATE OF MULTI-SOURCE MEDICAL INFORMATION



(57) Abstract

The present invention provides a system for updating multi-source medical information on a medical information unit immediately upon a patient's receiving medical service. The system typically includes a plurality of medical information units (308), one per patient, each medical information unit configured to identify a patient and to include at least certain medical information; a plurality of portable patient I/O units, each co-located with the patient (302); and a central database having an interface with the portable patient reader/writer units and a plurality of medical input databases (104-112).

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Description

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**METHOD, DEVICE AND SYSTEM FOR FACILITATING ENTRY  
AND UPDATE OF MULTI-SOURCE MEDICAL INFORMATION**

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This is a continuation-in-part of USSN 09/233,869 filed on January 20, 1999.

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**BACKGROUND OF THE INVENTION**

1. Field of the Invention

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This invention relates to a method, device and system for facilitating entry and updating of multi-source medical information, and more specifically, a method, device and system for facilitating entry and updating multi-source medical information using a medical information unit. Additionally, this invention relates to information carrying units which utilize RFID technology for providing information about wearers of the unit.

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2. Description of the Related Art

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Smart cards are generally plastic cards having an embedded integrated circuit that is used for storing information. Plastics used for substrates for the smart card typically may include materials such as ethyl-vinyl-acetate (EVA) as a soft copolymer located on an inside surface of the card and a tough polyester located on the outside surface. A hot melt adhesive such as EVA, phenolic butyral or silicone adhesive is generally used to seal the inner layer of the smart card to the tough outer polymeric layer which is typically polyester, mylar, polyimide or polyethylene. The above examples may be used to provide a thin, flexible smart card.

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Chips are generally attached to circuitry on the substrate by soldering, ultrasonic single point bonding, thermo-compression, or conductive adhesive.

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There are two types of smart cards: contact smart cards and contactless smart cards. Contact smart cards must be inserted into a smart card reader in order for the stored information to be accessed. For example, a contact smart card may employ an integrated circuit on a small gold plate about one-half inch in diameter (a chip) on the front of the card. When the smart card is inserted into the smart card reader, the gold plate portion of the smart card makes electrical contact with electrical connectors of the smart card reader so that data may be transferred to and from the chip. Typical uses of smart cards are identification of user, serving as electronic keys for access, controlling of access to information, etc.

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A contactless smart card has an embedded electronic microchip and an antenna. When the contactless smart card is passed near an antenna or coupler, the contactless smart card communicates with the antenna or coupler using a radio frequency signal. Thus, the contactless smart card does not require direct contact with an electrical circuit in order to function. Typical uses of the contactless smart card are for processes that must be accomplished quickly, such as toll collection or mass-transit fund collection.

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When a victim enters an emergency room in an unconscious state, the medical personnel may be unaware that the victim is carrying a smart

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card with this information. Also, where an outside laboratory has run medical tests on the victim, the outcomes of the tests from the outside laboratory may not be in the victim's file, and such information may be critical to treatment of the victim. The medical information needs to be convenient to access, available spontaneously with a minimum of effort, accurate and reliable. In addition, the system needs to be able to download medical information for an individual from a variety of sources to provide an updated medical profile of the individual.

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Thus, there is a need for a method, device and system for facilitating an update of multi-source medical information.

#### SUMMARY OF THE INVENTION

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The present invention provides a system for entering and updating multi-source medical information on a medical information unit immediately upon an individual's receiving medical service, or during the time that a patient is resident at a medical facility, including: a plurality of medical information units, one per individual or patient, each medical information unit configured to identify the individual or a patient and to include at least certain predetermined personal and medical information concerning the individual and/or patient; and a plurality of portable individual and/or patient input/output units, each co-located with the individual and/or patient, for inputting and displaying information from the medical information unit of the individual and/or patient. Each of the portable input/output units may include an interface with a central database for downloading to, and retrieving information, for the individual

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and/or patient, from a central database. The database can have an interface with a plurality of input databases including, for example, at least one of: a pharmacy database, a medical laboratory test facility database, a billing database or an insurance database. Typically, a central database can be accessible by at least one network. The medical information unit may be one of: a smart card, a pendant, or a "dog tag". The medical information unit can typically be attachable to an identification bracelet of a patient. The medical information unit may also be a pendant, wrist watch or an identification bracelet and a radio frequency identification unit.

In one embodiment, the present invention provides a system for facilitating a medical information entry and update for an individual arriving in a medical treatment area using multi-source medical information, including: at least two sensor arrays, arranged to provide a sensing field for an individual arriving at a medical treatment area, for indicating whether the individual is carrying a medical information unit; and an updating information unit for combining medical information for the individual on the medical information unit with information for the individual in a database to generate an updated medical profile of the individual. The medical identification unit may be one of: a smart card, a radio frequency tag or a pendant. The database is typically arranged to receive and store, automatically, information updates for the individual from a plurality of sources. The information entries and updates from the plurality of sources may include information for the individual from at least

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one medical laboratory and/or information for the individual from at least one physician's office.

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In one embodiment, the present invention provides a method for facilitating a medical information entry and/or update for an individual arriving in a medical treatment area using multi-source medical information, including the steps of:

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using at least two arrays of sensors forming a sensing field to identify whether the individual is carrying a medical information unit; and where the individual is carrying a medical information unit, combining medical information for the individual from the medical information unit with information for the individual in a database to generate an updated medical profile of the individual. The method may further include receiving and storing data and information, automatically, by the database, information entries and/or updates for the individual from a plurality of sources. The information entries and/or updates from the plurality of sources may include information for the individual from at least one medical laboratory and/or information for the individual from at least one physician's office.

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In one embodiment, the present invention provides device for facilitating a medical information update for an individual arriving in a medical treatment area using multi-source medical information, including: an alarm unit for indicating whether the individual is carrying a medical smart card; or a device information unit, coupled to the alarm unit, for, where the individual is carrying a medical smart card, combining medical

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information for the individual on the medical smart card with information for the individual in a to generate an updated medical profile of the individual. The database is generally arranged to receive and store, automatically, information entries and/or updates for the individual from a plurality of sources. The information updates from the plurality of sources may include information for the individual from at least one medical laboratory and/or information for the individual from at least one physician's office.

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In one embodiment, the present invention provides a device for using a medical smart card or combination card to generate a medical identification bracelet for an individual, including: a reader unit for reading a name of the individual from the medical smart card; and a bracelet generating unit for generating the medical identification bracelet with the name of the individual printed thereon. The device may further include a unit for generating an electronic information unit for the medical identification bracelet. The electronic information unit may include updatable predetermined medical information for the individual.

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In one embodiment the present invention provides a device for using a medical smart card to generate a medical identification unit for an individual, including: a reader unit for reading a name of the individual from the medical smart card; and a medical identification generating unit for generating a medical identification unit that includes electronic identification of the individual. The medical identification unit may include

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updatable predetermined medical information for the individual. The medical identification unit typically is one of: a bracelet or a pendant.

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In one embodiment, the present invention provides a system for entry and updating multi-source medical information on a medical information unit immediately upon a patient's receiving medical service, including: a plurality of patient medical information units, one per patient, each medical information unit configured to identify a patient and to include at least certain predetermined medical information concerning the patient; a plurality of provider medical information units, each medical information unit configured to identify the provider and the individual providing a provider service; and a plurality of portable input/output units, for inputting and displaying information from at least one patient medical information unit and from at least one provider medical information unit. Each of the portable input/output unit generally includes an interface with a database for downloading to, and retrieving information, for the at least one patient, from the database. The database typically has an interface with a plurality of input databases including at least one of: a pharmacy database, a medical laboratory test facility database, a billing database or an insurance database. A central database is generally accessible by at least one network. The medical information unit may be one of: a smart card, a pendant or a "dog tag". The medical information unit is generally attachable to an identification bracelet of the patient. The medical information unit may be one of a pendant or a radio frequency identification unit. At least one patient medical information unit and at

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least one provider medical information unit are typically utilized in accordance with a predetermined scheme to provide security for the medical information. When the provider service is provided, an identity of an individual providing the provider service, an identity of the patient, and a time and date of the provider service are generally entered on the medical information unit. At least one of the portable input/output units may be a computer with two processors that is used to segment input data in accordance with a predetermined scheme. The input/output unit can be a portable reader/writer capable of reading bar codes, radio frequency (RF) and dual cords.

Bar code taps can be attached to medication in a hospital pharmacy and matched to a patient's medical information unit for confirmation. The medical information unit can also be used to ensure proper meal service in an analogous manner.

In one embodiment of the invention, an RF interface board capable of reading both contact and contactless smart cords automatically can be employed. A transceiver, e.g., a 900Mhz transceiver can be used to transmit data to a database when the transceiver is employed in conjunction with a portable reader/writer. The transceiver will enable a user to access remote databases, PCs or mainframes. In addition to portable terminals, it is contemplated that various connected organizers, pen based electronic organizers, palm pilots or similar devices can be employed to input and/or receive data about an individual and/or patient.

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Programs similar to or analogous to the Microsoft CE operating system can be employed.

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With the present system, accountability in medical services can be assured. The administration of proper medication or medical services or the serving of proper meals can be monitored using the instant system.

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The present invention further relates to an information carrying unit which utilizes RFID technology for providing information about wearers of the unit and the use of the unit to identify and provide proper medical services to an individual. In general, the information carrying unit comprises a substrate capable of being worn by, attached to or imbedded within a carrier. The information is installed on an appropriate memory chip which is attached to the information carrying unit. It is envisioned that a possible use for the information carrying unit would be as a uniform identification system.

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The present information carrying unit can be used in non-communicative situations. An individual carrier of the information carrying unit can be identified and vital information about the individual carrier can be accessed in emergency situations. Access may be by use of the input/output devices and portable readers described above. The information could be accessed from the information carrying unit in a secure manner by authorized personnel and information would be stored on the information carrying unit in a memory chip attached to the unit. Possible forms for the unit could be for example, a bracelet, a pendant and wrist watch.

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It is envisioned by the information carrying units could be used to provide vital information to care providers in EMS, hospital emergency rooms, nursing homes or nursery schools. As also described above, the present unit could provide a system to ensure accountability by identifying both a service provider and the recipient of the service as well as the time and date of the services which were provided. In nursery schools, attendance records and special needs of children could be maintained on the present RFID information carrying unit.

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Errors in services provided to patients could be avoided by the instant RFID information carrying unit. Hence, confusion in meals, medication or procedures can be avoided.

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The present invention also provides an improvement in card tags. Such tags are worn by employees such as in hospital meal services and pharmacy with the present RFID information carrying unit can provide employee identification and access to an order entry computer system. One an order is entered the RFID information carrying unit can be used to verify that the order is correct.

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RFID information units can be used for identifying employees in the time-and-attendance management, in addition to access control. Passive RFID "proximity" cards and tags can record time in and out data and permit positive employee ID for contact with individuals with access to secured areas.

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The RFID can provide basic personal health information. This includes, for example. Medical history, shots, allergies and specific

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medical problems as well as current medication. When appropriate, an individuals medical records can be accessed at the physician's office in the normal visit.

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An RFID in the form of a card or pendant can be employed with basic information. Readers to access the information could be present in all physicians, offices, ambulances, police cars, emergency medical vehicles and fire department vehicles. The obvious benefits for quickly obtaining vital information becomes apparent with the additional information that may assist in identifying existing medical and/or identification problems.

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Additional information not found on other medical ID cards could be incorporated, such as, for example:

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1. EKG for comparative evaluation analysis
2. DNA section for positive identification
3. Organ donor consent form
4. Do Not Resuscitate
5. Global Position Location Chip

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In the event of hospitalization, the RFID enables the transfer of patient information through the treatment process with precision and accountability. The events that would become an electronic record would follow the patient through the following procedures:

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1. Admissions (normal or emergency)
2. Radiology if required
3. Surgery if required

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4. Recovery if required

5. Patient contracts by:

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a. nurse

b. physician

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c. pharmacy

d. meal attendants

e. therapists

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6. Release

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In order to update information, the attending physician, nurse, therapist or qualified attendant may access the individual memory chip with a RF reader writer of the types described above. The time, date and care providing identification would be recorded on the memory chip.

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Other features and advantages of the present invention will become apparent from the following description of the preferred embodiments of the present invention which are shown in the accompanying drawings.

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#### BRIEF DESCRIPTION OF THE DRAWINGS

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FIG. 1 is a block diagram of one embodiment of a system in accordance with the present invention.

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FIG. 2 is a flow chart showing one embodiment of steps in accordance with the method of the present invention.

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FIG. 3 is a block diagram of one embodiment of a device for facilitating a medical information update in accordance with the present invention.

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FIG. 4 is a block diagram of another embodiment of a system in accordance with the present invention.

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FIG. 5 is a block diagram of another embodiment of a device in accordance with the present invention.

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FIG. 6 is a block diagram of another embodiment of a device in accordance with the present invention.

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FIG. 7 is a diagrammatic representation of another embodiment of a system for updating multi-source medical information on a medical information unit immediately upon a patient's receiving medical service in accordance with the present invention.

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FIG. 8 is a diagrammatic representation of an embodiment of a system for updating multi-source medical information on a medical information unit immediately upon a patient's receiving medical service including intravenous treatment in accordance with the present invention.

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FIG. 9 is a block diagram of another embodiment of a system in accordance with the present invention.

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FIG. 10 is a diagrammatic representation of an embodiment of the system of the present invention shown with greater particularity including exemplary information carrying units.

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FIG. 11 is a block diagram of an embodiment of a system in accordance with the present invention in which a dual card reader is utilized.

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**DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS**

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The cost for manufacturing a smart card is slightly more than ten times the cost for the manufacture of a credit card with a magnetic strip on the back. However, smart cards have the benefit of providing centralization of information since they have more functionality than credit cards, which operate without use of a user code recognition system. Thus, the greater functionality and security of the smart cards make such cards a preferred choice for medical information storage.

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FIG. 1, numeral 100, shows a block diagram of a system in accordance with the present invention. A medical treatment facility 102 has an entrance room 104 with a plurality of sensors 106 arranged on both sides of the entrance to detect the presence of a radio frequency tag on a medical smart card when an individual having a medical information unit with a radio frequency (RF) tag passes through the sensing field between the sensors.

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The RF tag contains in its memory an information code identifying its owner and any other selected information. For added security, certain information may be encrypted. Typically, however, information such as the name of the individual, blood type, presence of a diabetic condition and the like will typically not be encrypted.

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In one embodiment, an encryption key may be a software code that is only available to the issuer of the medical smart card. The de-encryption key may be public so that anyone having the de-encryption key may read information in the memory of the tag, but only the issuer of the

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medical smart card can write information on the tag. For example, medical insurance billing information may be selected to be encrypted.

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Information on a smart card typically may be divided into four groups: read only, added information, updated information, and secure information. Access to the information on the smart card may be open to anyone, such as access to a person's blood type, allergies, diabetic condition and the like. In contrast, certain information on the smart card may be protected by password or a personal identification number (PIN). A PIN usually consists of four or five numbers, symbols or alphabetic characters, individually or in combination, often with a backup security that disables the smart card when a predetermined number of inaccurate PIN entries have been executed. Alternatively, some smart cards are arranged so that only the issuing body, e.g., a metro office, can reload the smart card. Though authenticated biometrics such as fingerprints and voiceprints have been suggested as security measures, since biometrics data are generally stored in electronic form, such data is reproducible, and thus also represents security risk.

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RF tags are known in the art. The use of RF anti-theft tags that cause a sound to be emitted when an item that was not paid for passes through the sensor field is known. Such RF tags may be deactivated when a purchase is made so that no sound is caused to be emitted when the purchased item passes through the sensor field. In the present invention an RF tag is typically embedded in a medical smart card or in a pendant, may be used alone, or, for example in a "dog tag" version

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wherein the RF tag is embedded in a "dog tag" similar to those used in the armed forces. In the present invention the RF tag is used to activate the alarm sensors as the individual enters the medical treatment facility.

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As shown in FIG. 1, numeral 100, at least two sensor arrays 106 are typically placed proximate to the vertical sides of a doorway of an entrance room 104 of the medical treatment facility 102. The two sensor arrays 106 provide a sensing field as is known in the art. When the two sensor arrays 106 detect the presence of a medical information unit, typically a medical smart card, dog tag or pendant, the sensor arrays alert the medical personnel, generally by causing a sound to be emitted, and the individual passing through the entrance is identified as having a medical information unit on his person. Clearly, the system may alternately, or in addition, provide flashing lights or any other type of predetermined notification of the presence of the medical information unit.

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When the alert is generated, the medical personnel may ask the individual for the medical information unit, or, where this is not an option, may search the individual and obtain the medical information unit. It may be a contact medical smart card, a contactless medical smart card, a dog tag or a pendant. A reader 110 for a smart card, dog tag or a pendant is a data extraction unit that is utilized to obtain the name, the identification code and any other medical information on the medical smart card together with other information, if any, for the individual in the database 112 and any other sources coupled to transfer information to the database 112. The reader may, where desired, also have the capability of

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writing to the medical information unit or to any other unit (not shown – for example, a database) that is coupled to the reader 110. Thus, medical personnel may update information on the medical information unit each time a medical service and/or medicine is administered to a patient. For example, a reader/writer may be installed in each patient room or at the bedside of each patient. Upon treatment by the physician or other medical personnel, information describing what has taken place may be entered on the medical information unit, and, where selected, may also be used to update a central medical database as well as a centralized billing system.

The identification code or social security number on the medical information unit serves as a type of backup system for being sure that the medical information is being correlated with the correct individual. Thus, in the event that there is more than one "John Smith", the identification code clarifies which "John Smith" the individual is. The smart card reader, dog tag reader or pendant reader 110 may be arranged with, or be a part of, an updating information unit 108 (typically a computer system) that is used to access the medical facility database 112. The medical facility database 112 may be coupled to receive information from a physician's office 114, a medical laboratory 116 or the like. Thus the individual, even if he is unconscious and unable to identify himself or provide vital information such as blood type, may be aided by the updated medical information provided by the system of the present invention and medical personnel have the advantage of having access to updated

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medical information for the individual, including historical as well as recent medical information.

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FIG. 2, numeral 200, is a flow chart showing one embodiment of steps in accordance with the method of the present invention. The method facilitates medical information update for an individual by combining multi-source medical information based on an information code on a medical smart card that identifies the individual and predetermined medical facts about the individual. The individual may be in a hospital, an emergency medical service vehicle, a police vehicle, a physician's office or any other place where medical information is needed to assist an individual. The method includes the steps of: using 202 at least two arrays of sensors forming a sensing field to identify whether the individual is carrying a medical information unit; and where the individual is carrying a medical information unit, combining 204 medical information for the individual from the medical information unit with information for the individual in a database to generate an updated medical profile of the individual. Where selected, the method may further include receiving and storing 206, automatically, by the database, information updates for the individual from a plurality of sources. For example, the information updates from the plurality of sources include information from at least one medical laboratory and/or information from at least one physician's office.

In another embodiment the sensors for detecting the presence of the medical information unit may be incorporated into a portable alarm

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device or scanner 302. In a preferred embodiment, the portable device is handheld.

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FIG. 3, numeral 300, is a block diagram of one embodiment of the portable device 302 for facilitating a medical information update. The device 302 has an alarm unit 304 for indicating whether the individual is carrying a medical information unit 308. In addition, the device 302 has a device information unit 306, coupled to the alarm unit 304, for, where the individual is carrying a medical information unit 308, combining medical information associated with a name of an individual and/or an identification code of the medical information unit 308 with information associated with the name of the individual and/or the identification code in a database to generate an updated medical profile of the individual. The alarm unit 304 includes a plurality of sensors that, when the device 302 is passed in proximity to the body of the individual, detect whether the individual is carrying a medical information unit 308. Operation of sensors is known to those skilled in the art and will not be described further here. Where the plurality of sensors detect a medical information unit 308, a detection alert is typically indicated by a light or light emitting diode on the device turning on or a sound being emitted from the device 302. Thus, the alarm unit 304 generally includes a detection alert system to implement the alert.

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When medical personnel use the portable alarm device 302 and the detection alert system provides an alert, the personnel locate the medical information unit 308. The device information unit 306 includes a reader

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310 which has the capability of reading contactless and contact smart  
cards as well as pendants, dog tags and RF tags. Where the medical  
10 information unit 308 is a contactless medical smart card, RF tag, dog tag  
or pendant, the smart card, RF tag, dog tag or pendant is held in proximity  
to the reader 310 to allow the information on the smart card to be  
15 transmitted to the device. Current technology allows a reader-writer to be  
up to five (5) feet away from the medical information unit. Where the  
20 medical smart card is a contact smart card, the smart card is inserted into  
the reader 310. The device may include a display screen 312 with  
controls for selectively viewing the information, e.g., by scrolling. In  
25 addition or alternatively, as desired, the device information unit 306 may  
be arranged to provide downloading to or exchanging of information with  
30 a database. Typically, this is accomplished either by an RF transfer with  
the database or by plugging a database connection 314 of the portable  
device directly into a wire connection or placing the database connection  
35 314 of the portable device into contact with a cradle (not shown) that is  
designed to facilitate information transfer between a database and the  
portable device or synchronize information between them. Since the  
40 technology for cradles and wire connections for handheld computing  
devices to permit data transfer is known, it will not be described further  
45 here.

FIG. 4, numeral 400, sets forth a block diagram of another  
embodiment of a system in accordance with the present invention. A  
50 smart card 402, a card with a magnetic strip 404 (a "swipe" card), a dog



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tag or a radio frequency identification (RFID) device 406 such as a pendant or RFID smart card may be read by a dual reader writer unit 408 coupled to a monitor 410. The dual reader writer unit 408 provides the capability of security, accountability and adding further information to the smart card 402, the swipe card 404, dog tag or the RFID device 406. In one embodiment, the dual reader writer unit provides a two medical information unit system in which the patient and the person attending to the patient must both have their medical information units accessed and recorded with the identity, time and date of contact. Thus, in all contacts that involve medical treatment, both the care provider's medical information unit and the patient's medical information unit are accessed, providing current medical information for the patient at the time of treatment. Where selected, computers with two processors may be used to segment the input data in accordance with a predetermined scheme. Where the medical treatment facility is arranged to serve a number of individuals, there may be a plurality of dual reader writer units 408, 424 and monitors 410, 426 coupled to the database 412.

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Thus, in a medical treatment room of a medical treatment facility for example, any vital information such as medication administered may be added and, where desired, may also be recorded in a database 412 (database with database interface). Where desired, the database 414 may be coupled to a network 414, which may be accessed by a computer 416, a handheld device, a cellular device 418 or the like. The database 412 may also be coupled to a plurality of selected databases, for example,

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databases for a radiology unit 428, a pharmacy 430, a laboratory 432, a nurses' station 434, a billing or accounting unit 420, a smart card case specific unit 422 or the like, any of which may be located at the medical treatment facility or offsite.

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As shown in the block diagram of FIG. 5, numeral 500, the device 502 may be embodied in an identification unit that uses a medical smart card to generate a medical identification bracelet 510 for an individual. The identification unit includes a reader unit 504 for reading a name of the individual from the medical smart card; and a bracelet generating unit 506 for generating the medical identification bracelet with the name of the individual printed thereon. For example, the bracelet generating unit 506 may be a computer coupled to a device for printing the medical identification bracelet 510. The identification unit may also include an electronic information generating unit 508 for generating an electronic information unit for the medical identification bracelet 510 or alternatively, may allow the medical information unit to be affixed thereto. The electronic information unit may be attached to the medical identification bracelet 510 so that additional information is readily available. Typically, the electronic information unit includes updatable predetermined medical information for the individual.

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medical identification generating unit 606 for generating a medical identification unit 610 that includes electronic identification of the individual. As above, the medical identification unit 610 may include updatable predetermined medical information for the individual, and may also include an electronic information generating unit 608 for generating an electronic information unit 612 for the medical identification unit 610. The electronic information unit 612 may be attached to or incorporated into the medical identification unit. The medical identification unit 610 is typically a bracelet or a pendant to be worn by the individual.

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As shown in FIG. 7, numeral 700, the present invention may include a system for updating multi-source medical information on a medical information unit immediately upon a patient's receiving medical service. The system includes a plurality of medical information units 702,...(one per patient), a plurality of portable patient input/output units 706, ...(each co-located with at least one patient), and a central database 714. Each medical information unit includes information that identifies the patient wearing or having the medical information unit 702. If desired, selected predetermined medical information, such as blood type, whether the patient has diabetes, the type of diabetes, etc., may also be included on the medical information unit. Each of the plurality of portable patient input/output units is co-located with at least one patient and includes a reader for obtaining information from the medical information unit 702, a display unit 712 for displaying the information obtained, and where selected, a writer for adding information to the medical information

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5 unit and/or a central database. The co-location of the portable patient  
input/output unit 706 with the patient being treated facilitates the input  
10 and display of information from the medical information unit for the  
patient. Also, this arrangement aids personnel in downloading and  
retrieving medical and/or billing information for the particular patient from  
15 a central database. The central database has an interface with each of  
the portable patient input/output units and may also include an interface  
with a plurality of medical input databases. For example, interfaces to  
20 receive pharmaceutical and/or laboratory test information may be utilized.  
The central database may be coupled to each portable patient input/output  
25 unit via wireless or wired connection. The input unit 708 for the portable  
patient input/output unit 706 may utilize speech recognition, touchscreen  
technology using alphabetic and numeric characters, or any other known  
30 input technology. The central database may also be accessible by at least  
one network. For example, the central database may be accessible by cell  
35 phone, a personal digital assistant, a computer, the internet or the like.  
Again, security for the system will be typically be predetermined by the  
system's owner. Typically, the medical information unit is one of: a smart  
40 card, a pendant or a "dog tag".

Typically where the size of the medical information unit has been  
45 minimized, such as where the medical information unit is a pendant or a  
small RFID device, the medical information unit 702 may be attachable to  
an identification bracelet 704 of the patient, as shown in FIG. 7.  
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Generally, the medical information unit is either a pendant or another version of a radio frequency identification unit.

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FIG. 8, numeral 800, is a diagrammatic representation of an embodiment of a system for updating multi-source medical information on a medical information unit immediately upon a patient's receiving medical service including intravenous treatment in accordance with the present invention. Note that, in addition to the plurality of medical information units 802,...(one per patient), the plurality of portable patient input/output units 806, ...(each co-located with at least one patient), and a central database 814, the system includes an intravenous attaching unit 816 that allows medical personnel to attach the intravenous connecting apparatus to the bracelet 804 to stabilize the intravenous connection to the patient. The portable patient input/output unit 806 includes an input unit 808, a reader 810 and a display unit 812 as described above for FIG. 7.

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By incorporating RFID transceivers in every area that a patient may occupy in a medical treatment setting, a record may be maintained showing the data and time of each treatment. For example, an order of events might be: arrival via an Emergency Medical Service Vehicle, ambulance, police car or fire vehicle, emergency room treatment, treatment from radiology, admission information input, input from a nurse's station, hospital room input, operating room input, recovery room input, and discharge station input. The above events would include input from and identification of all persons that had contact with the patient, including physicians, nurses, aides, drug dispensers, admission stations,

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and food dispensers. Thus, all billable services are recorded at the time of patient contact, expediting the billing process. In addition, other services such as reception desk services, recovery room services, and pharmacy services may be entered directly on the medical information unit. Placement of RFID transceivers for the medical information unit in police vehicles, fire department vehicles, emergency medical service vehicles, police stations and fire stations would facilitate access and update of medical information.

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An office visit to a physician is a shorter version of the hospital system described above, since typically fewer services are utilized during a patient's visit with a physician. The physician carries out his examination of the patient, records the examination using a patient input/output unit and adds any other information needed.

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FIG. 9, numeral 900, shows a block diagram of another embodiment of a system in accordance with the present invention. An RFID pendant 902, smart card 904, smart card with RFID 906, or a "dog tag" (SC-RFID 908) is a medical information unit having information that may accessed using a transmitter/receiver 910 with a monitor 912, server 914 with a monitor 912, or reader/writer 916 with a monitor 918. Medical information may further include information from radiology 920, a work station 922, a pharmacy 924, a billing unit 926, or the like, typically coupled to the transmitter/receiver 910, server 913 or reader/writer 916 by another server 928.

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In the diagrammatic representation shown in FIG. 10, numeral 1000, the system of the present invention wherein the RFID pendant is shown attached to an identification bracelet 1004 that includes an intravenous device holder. Input from the pendant 1002, a smart card with RFID 1006, a smart card 1008 or military dog tags 1010 is read by a hand held scanner/reader 1012, a dual card reader 1014, or a reader-writer 1016 and may be shared with a central office 1018 and/or a branch office 1020. In one configuration, the smart card may be implemented with an RFID chip. In the field, the hand held scanner/reader may provide emergency information for an individual. In the embodiment of FIG. 10, a Windows NT Primary Domain Controller controls client authentication from the central office, and a management station, i.e., any personal computer equipped with a Web browser, is used to configure the boot server at each branch and to set user and group rights and privileges. Medical history may be maintained such that it may only be accessed by authorized personnel. Typically a wide-area network couples the central office 1018 to the branch office 1020. In one embodiment, the branch office 1020 includes an IBM Network Station Manager that runs as the boot server and applications server, running on a Windows NT Server 4.0 with Service Pack 3.0. Clients may obtain their applications and management tasks from the boot server, and their host connections through a 56 Kbps link to the central office's 3270 host.

FIG. 11, numeral 1100, is a block diagram of an embodiment of a system in accordance with the present invention in which a dual card

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reader is utilized. In this embodiment a medical information unit such as a RFID pendant/pendant on a wristband 1102, an RFID plus a smart card 1104, or a smart card 1106 is read by a fixed scanner 1108 or a hand-held scanner 1110 and the information is sent to a computer 1112 by wireline or by wireless. A computer 1112 suitable for use in the present invention typically includes a keyboard 1128 and monitor 1126 and may, where selected, include a dual card security system 1124. The dual card security system 1124 generally requires input of a smart card/pendant/dog tag of a patient together with input of a smart card/pendant/dog tag of a preapproved service provider in order for access to be allowed to medical information/billing and the like. The computer 1112 is generally coupled (wireless or wireline) to at least one server that may be coupled to a plurality of information sources such as a records unit 1118, a pharmacy 1120, a billing unit 1122 or the like and may also be coupled to receive and transfer information using the internet 1116.

Although the present invention has been described in relation to particular preferred embodiments thereof, many variations and modifications and other uses will become apparent to those skilled in the art. It is preferred, therefore, that the present invention be limited not by the specific disclosure herein, but only by the appended claims.



# Claims

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## WHAT IS CLAIMED IS:

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1. A system for entering and updating multi-source information on a medical information unit immediately upon a patient's receiving medical service, comprising:

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a plurality of medical information units, one per patient, each medical information unit configured to identify a patient and to include at least certain predetermined information concerning the patient; and

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a plurality of portable patient input/output units, each co-located with at least one patient, for inputting and displaying information from the medical information unit of the at least one patient.

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2. The system of claim 1 wherein each of the portable patient input/output unit includes an interface with a central database for downloading to, and retrieving information, for the at least one patient, from the central database.

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3. The system of claim 2 wherein the central database has an interface with a plurality of input databases including at least one of: a pharmacy database, a medical laboratory test facility database, a billing database or an insurance database.

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4. The system of claim 1 wherein the central database is accessible by at least one network.

5. The system of claim 1 wherein the medical information unit is one of: a smart card, a pendant, or a "dog tag" wrist watch with attached chip.

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6. The system of claim 1 wherein the medical information unit is attachable to an identification bracelet of the patient.

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7. The system of claim 1 wherein the medical information unit is one of a pendant or a radio frequency identification unit.

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7a. The system of claim 1, wherein the input/output unit is a portable reader/writer.

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7b. The system of claim 7a, wherein the portable reader/writer is capable of reading bar code, radio frequency and dual cards.

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7c. The system of claim 1, further comprising an RF interface board capable of reading both contact and contactless smart cards automatically.

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7d. The system of claim 7a, further comprising a transceiver capable of transmitting data to a data base from the portable reader/writer.

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7e. The system of claim 1, further being adapted so that connected organizers, pen based organizers or palm pilot devices may access the database.

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7f. The system of claim 1, wherein data can be updated or entered by voice recognition.

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8. A system for facilitating a medical information update for an individual arriving in a medical treatment area using multi-source medical information, comprising:

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at least two sensor arrays, arranged to provide a sensing field for the individual arriving at the medical treatment area, for indicating whether the individual is carrying a medical information unit; and

an updating information unit for combining medical information for the individual on the medical information unit with information for the individual in a database to generate an updated medical profile of the individual.

9. The system of claim 8 wherein the medical identification unit is one of: a smart card, a radio frequency tag or a pendant.

10. The system of claim 8 wherein the database is arranged to receive and store, automatically, information updates for the individual from a plurality of sources.

11. The system of claim 10 wherein the information updates from the plurality of sources include information for the individual from at least one medical laboratory.

12. The system of claim 10 wherein the information updates from the plurality of sources include information for the individual from at least one physician's office.

12a. The system of claim 8, wherein the updating information unit is a portable reader/writer.

12b. The system of claim 12a, wherein the portable reader/writer is capable of reading bar code, radio frequency and dual cards.

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12c. The system of claim 8, further comprising an RF interface board capable of reading both contact and contactless smart cards automatically.

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12d. The system of claim 12a, further comprising a transceiver capable of transmitting data to a data base from the portable reader/writer.

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12e. The system of claim 8, further being adapted so that connected organizers, pen based organizers or palm pilot devices may access the database.

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12f. The system of claim 8, wherein data can be updated or entered by voice recognition.

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13. A method for facilitating a medical information update for an individual arriving in a medical treatment area using multi-source medical information, comprising the steps of:

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using at least two arrays of sensors forming a sensing field to identify whether the individual is carrying a medical information unit; and

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where the individual is carrying a medical information unit,

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combining medical information for the individual from the medical information unit with information for the individual in a database to generate an updated medical profile of the individual.

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14. The method of claim 13 further including receiving and storing, automatically, by the database, information updates for the individual from a plurality of sources.

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15. The method of claim 14 wherein the information updates from the plurality of sources include information for the individual from at least one medical laboratory.

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16. The method of claim 14 wherein the information updates from the plurality of sources include information for the individual from at least one physician's office.

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17. A device for facilitating a medical information update for an individual arriving in a medical treatment area using multi-source medical information, comprising:

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an alarm unit for indicating whether the individual is carrying a medical smart card; and

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a device information unit, coupled to the alarm unit, for, where the individual is carrying a medical smart card, combining medical information for the individual on the medical smart card with information for the individual in a to generate an updated medical profile of the individual.

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18. The device of claim 17 wherein the database is arranged to receive and store, automatically, information updates for the individual from a plurality of sources.

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19. The device of claim 18 wherein the information updates from the plurality of sources include information for the individual from at least one medical laboratory.

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20. The device of claim 18 wherein the information updates from the plurality of sources include information for the individual from at least one physician's office.

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21. A device for using a medical smart card to generate a medical identification bracelet, pendant or wrist watch for an individual, comprising:

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a reader unit for reading a name of the individual from the medical smart card; and

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a bracelet generating unit for generating the medical identification bracelet with the name of the individual printed thereon.

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22. The device of claim 21 further including means for generating an electronic information unit for the medical identification bracelet.

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23. The device of claim 22 wherein the electronic information unit includes updatable predetermined medical information for the individual.

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24. A device for using a medical smart card to generate a medical identification unit for an individual, comprising:

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a reader unit for reading a name of the individual from the medical smart card; and

a medical identification generating unit for generating a medical identification unit that includes electronic identification of the individual.

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25. The device of claim 24 wherein the medical identification unit includes updatable predetermined medical information for the individual.

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26. The device of claim 24 wherein the medical identification unit is one of: a bracelet or a pendant or wrist watch.

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27. A system for updating multi-source medical information on a medical information unit immediately upon a patient's receiving medical service, comprising:

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a plurality of patient medical information units, one per patient, each medical information unit configured to identify a patient and to include at least certain predetermined medical information concerning the patient;

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a plurality of provider medical information units, each medical information unit configured to identify the provider and the individual providing a provider service; and

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a plurality of portable input/output units, for inputting and displaying information from at least one patient medical information unit and from at least one provider medical information unit.

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28. The system of claim 27 wherein each of the portable input/output unit includes an interface with a central database for downloading to, and retrieving information, for the at least one patient, from the central database.

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29. The system of claim 28 wherein the central database has an interface with a plurality of input databases including at least one of: a pharmacy database, a medical laboratory test facility database, a billing database or an insurance database.

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30. The system of claim 28 wherein the central database is accessible by at least one network.

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31. The system of claim 27 wherein the medical information unit is one of: a smart card, a pendant, or a "dog tag" or wrist watch.

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32. The system of claim 27 wherein the medical information unit is attachable to an identification bracelet or wrist watch of the patient.

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33. The system of claim 27 wherein the medical information unit is one of a pendant or a radio frequency identification unit.

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34. The system of claim 27 wherein at least one patient medical information unit and at least one provider medical information unit are utilized in accordance with a predetermined scheme to provide security for the medical information.

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35. The system of claim 34 wherein, when the provider service is provided, an identity of an individual providing the provider service, an identity of the patient, and a time and date of the provider service are entered on the medical information unit.

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36. The system of claim 27 wherein at least one of the portable input/output units is a computer with two processors that is used to segment input data in accordance with a predetermined scheme.

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36a. The system of claim 28, wherein the portable input/output unit is a portable reader/writer.

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36b. The system of claim 36a, wherein the portable reader/writer is capable of reading bar code, radio frequency and dual cards.

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36c. The system of claim 28, further comprising an RF interface board capable of reading both contact and contactless smart cards automatically.

36d. The system of claim 36a, further comprising a transceiver capable of transmitting data to a data base from the portable reader/writer.

36e. The system of claim 28, further being adapted so that connected organizers, pen based organizers or palm pilot devices may access the database.

36f. The system of claim 28, wherein data can be updated or entered by voice recognition.

37. An information carrying unit useful to provide pertinent information about an individual comprising a substrate capable of being worn by, attached to or embedded within an individual carrier and an appropriate memory chip attached to the information carrying unit wherein the information carrying unit acts as radio frequency (RF) identification device and the information contained on the information carrying unit is accessible by an RF reader.

38. The information carrying unit of claim 36, wherein the information contained on the unit provides personal information about the individual wearing the unit.

39. The information carrying unit of claim 36, wherein the unit is in the form of a bracelet, pendant or wrist watch.

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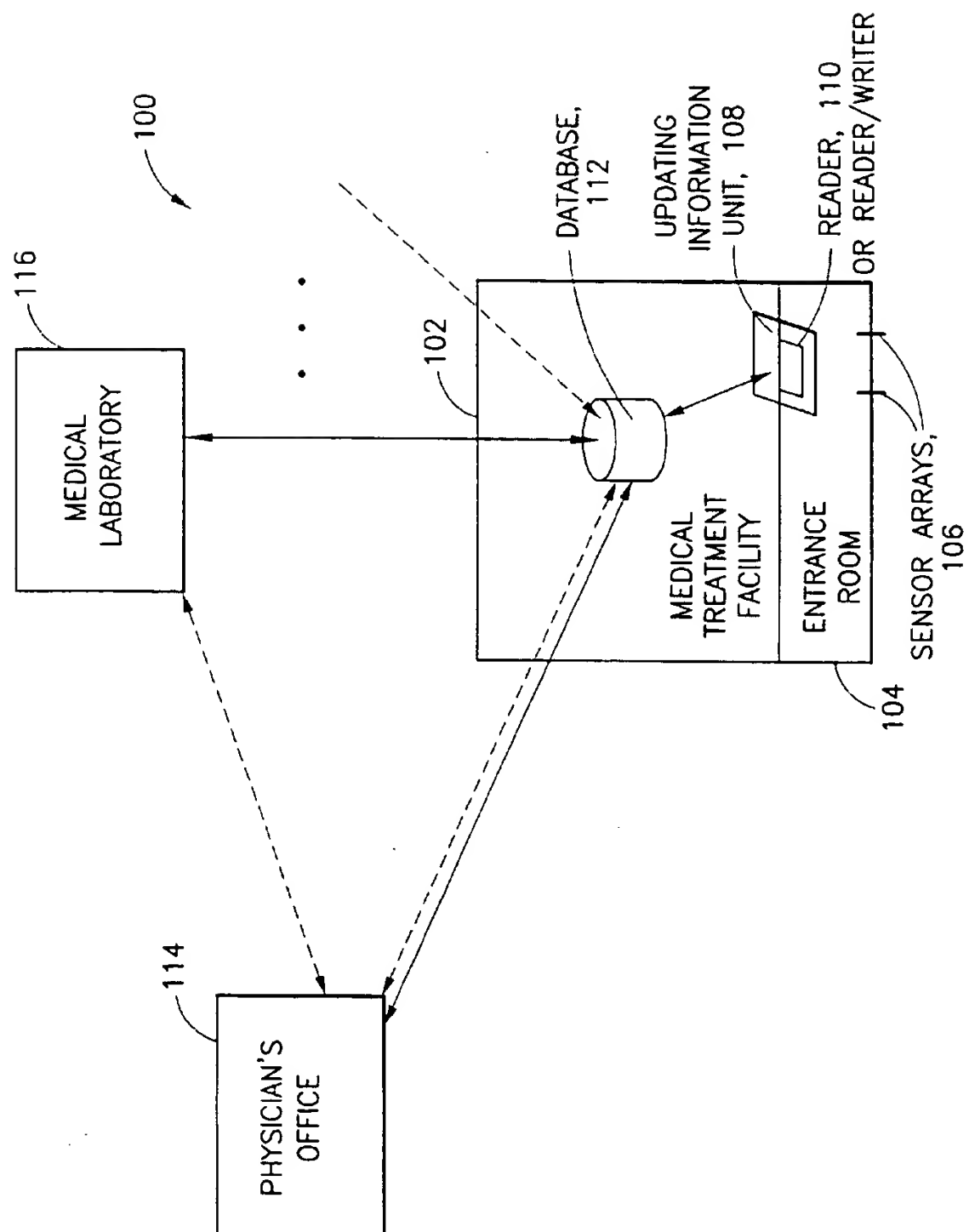


FIG.1

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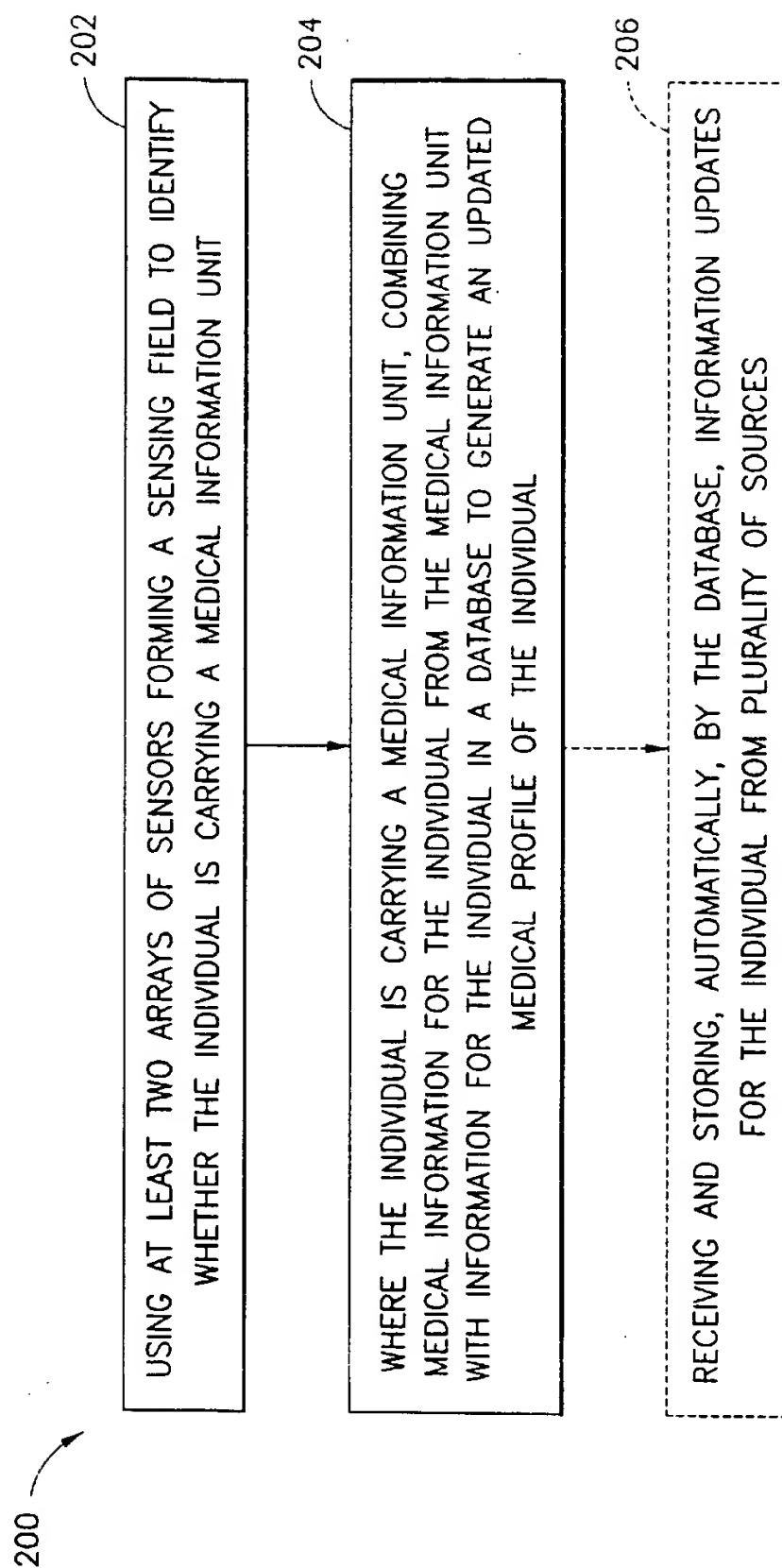


FIG. 2

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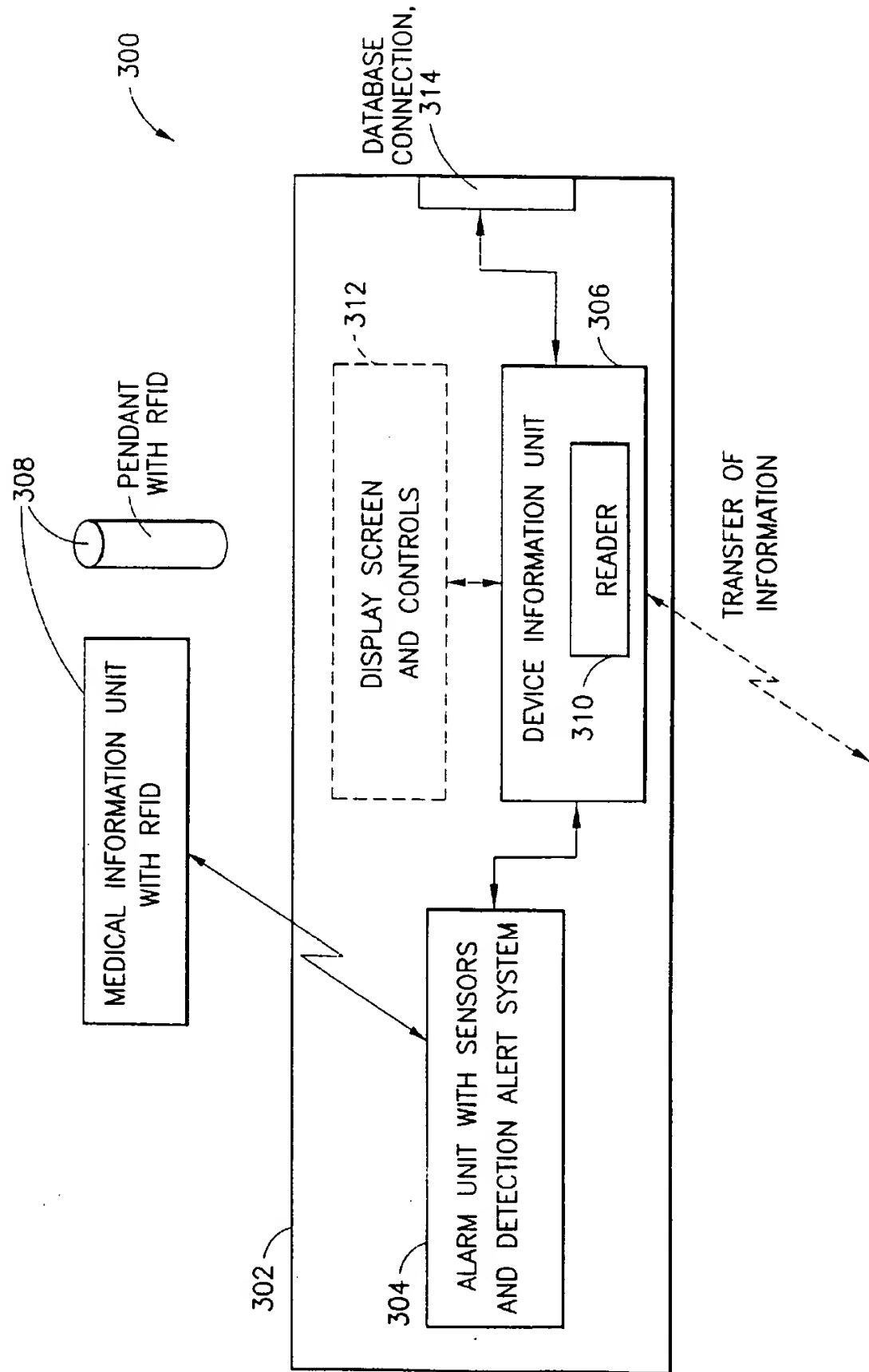


FIG.3

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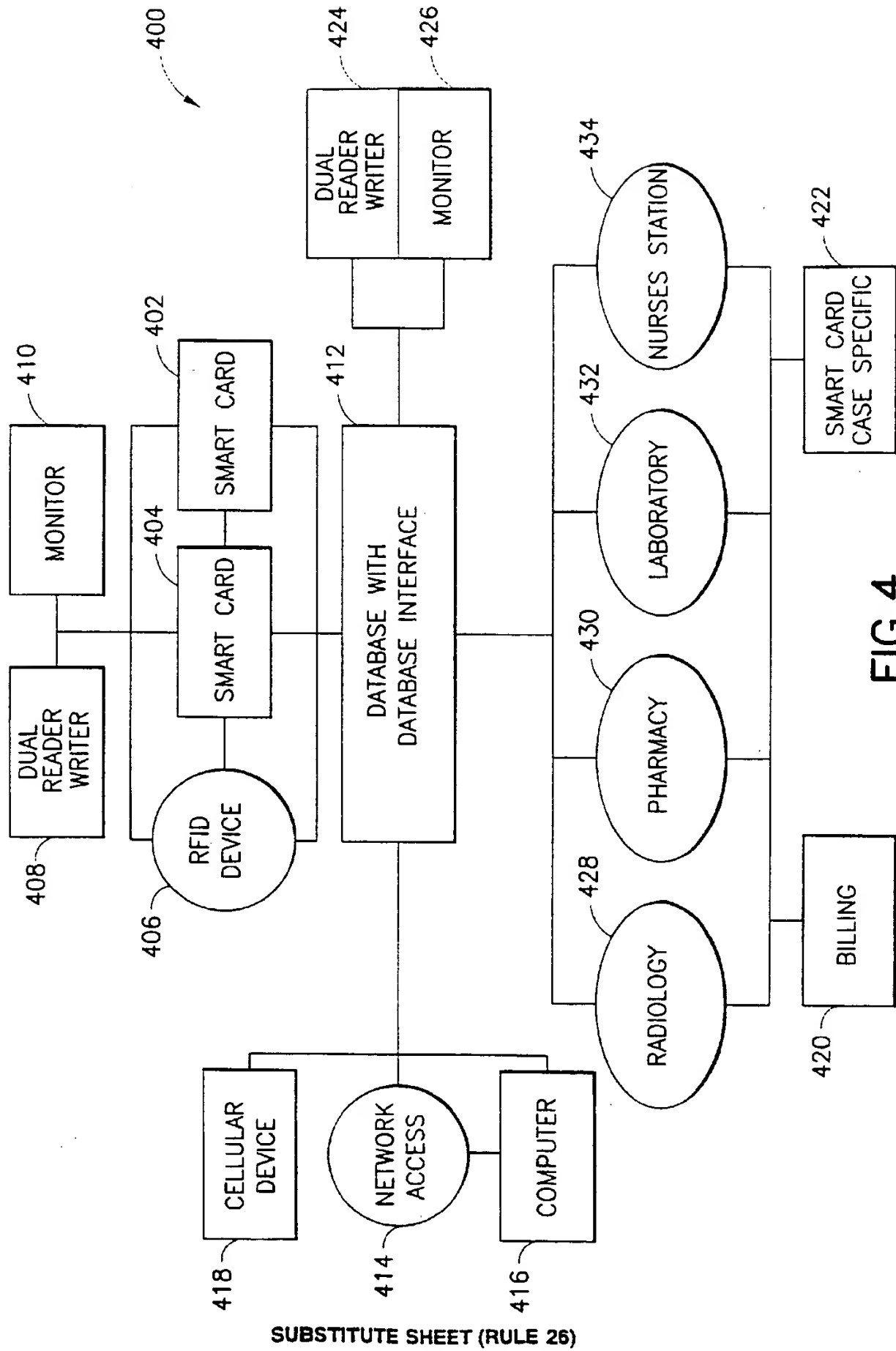


FIG. 4

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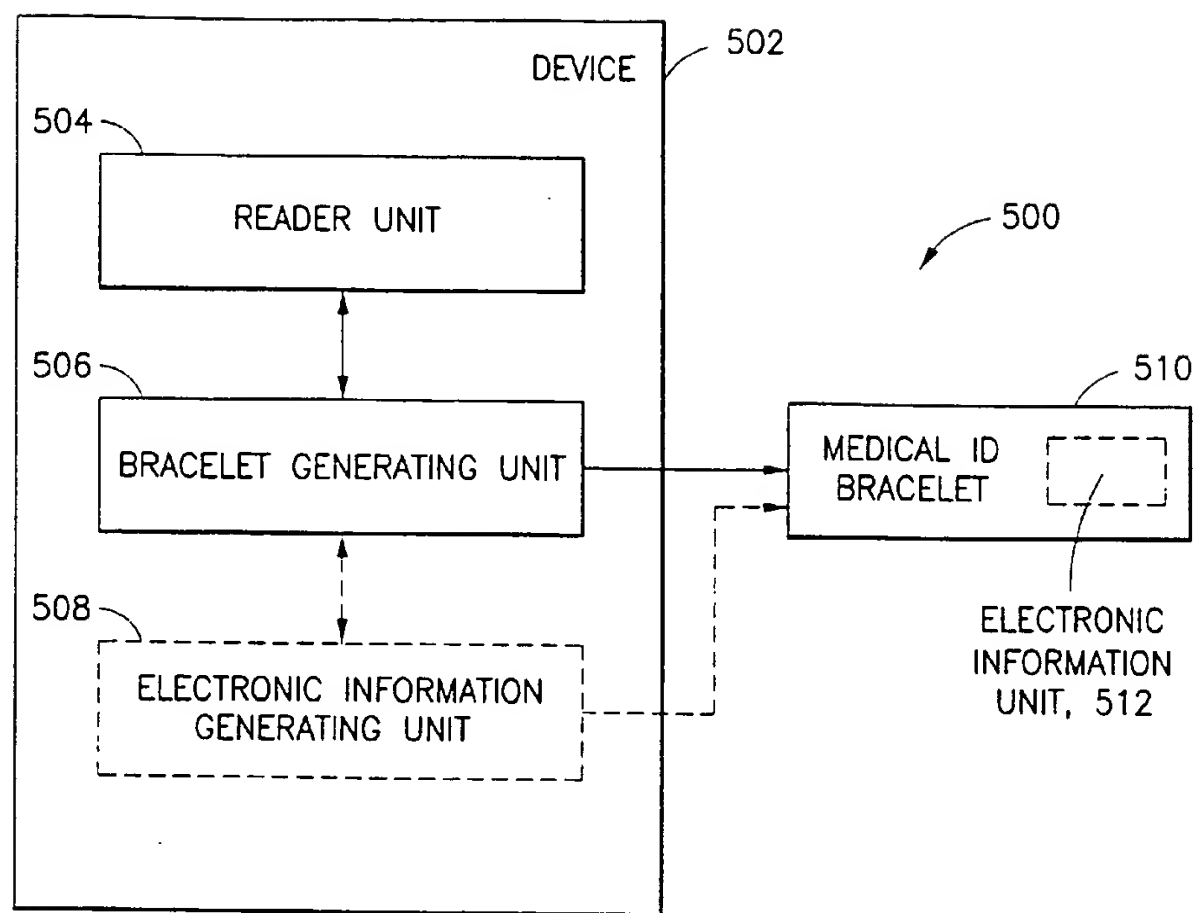


FIG.5

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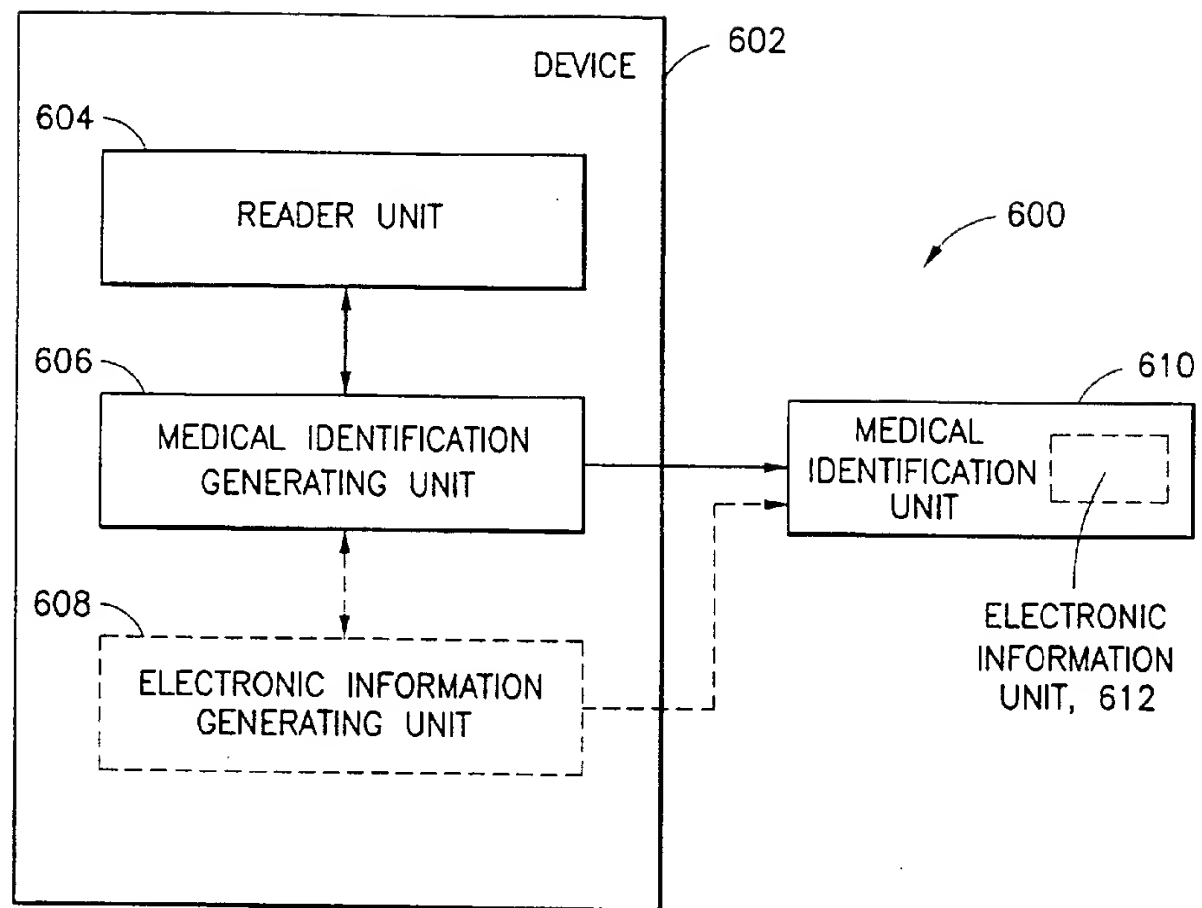
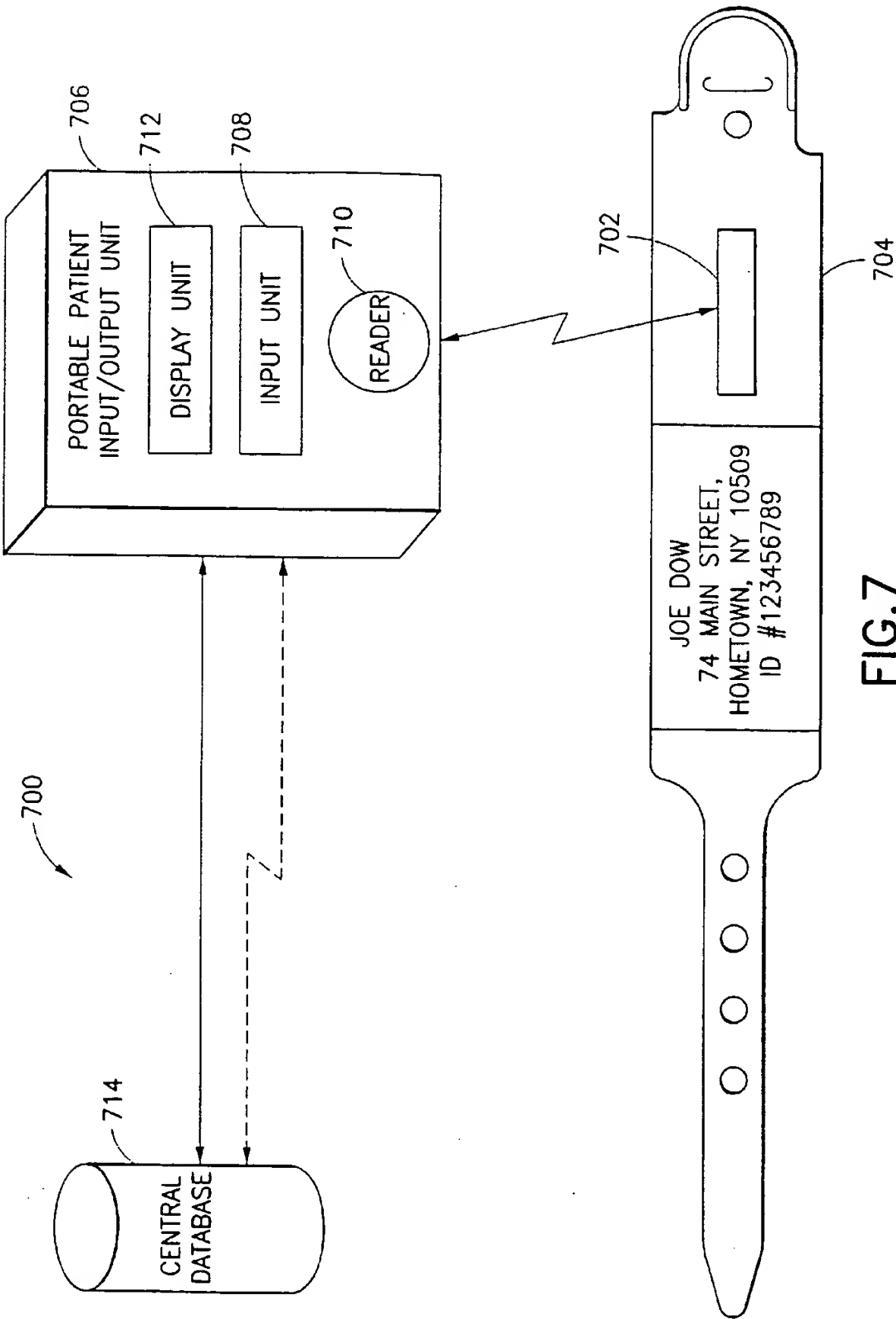


FIG.6





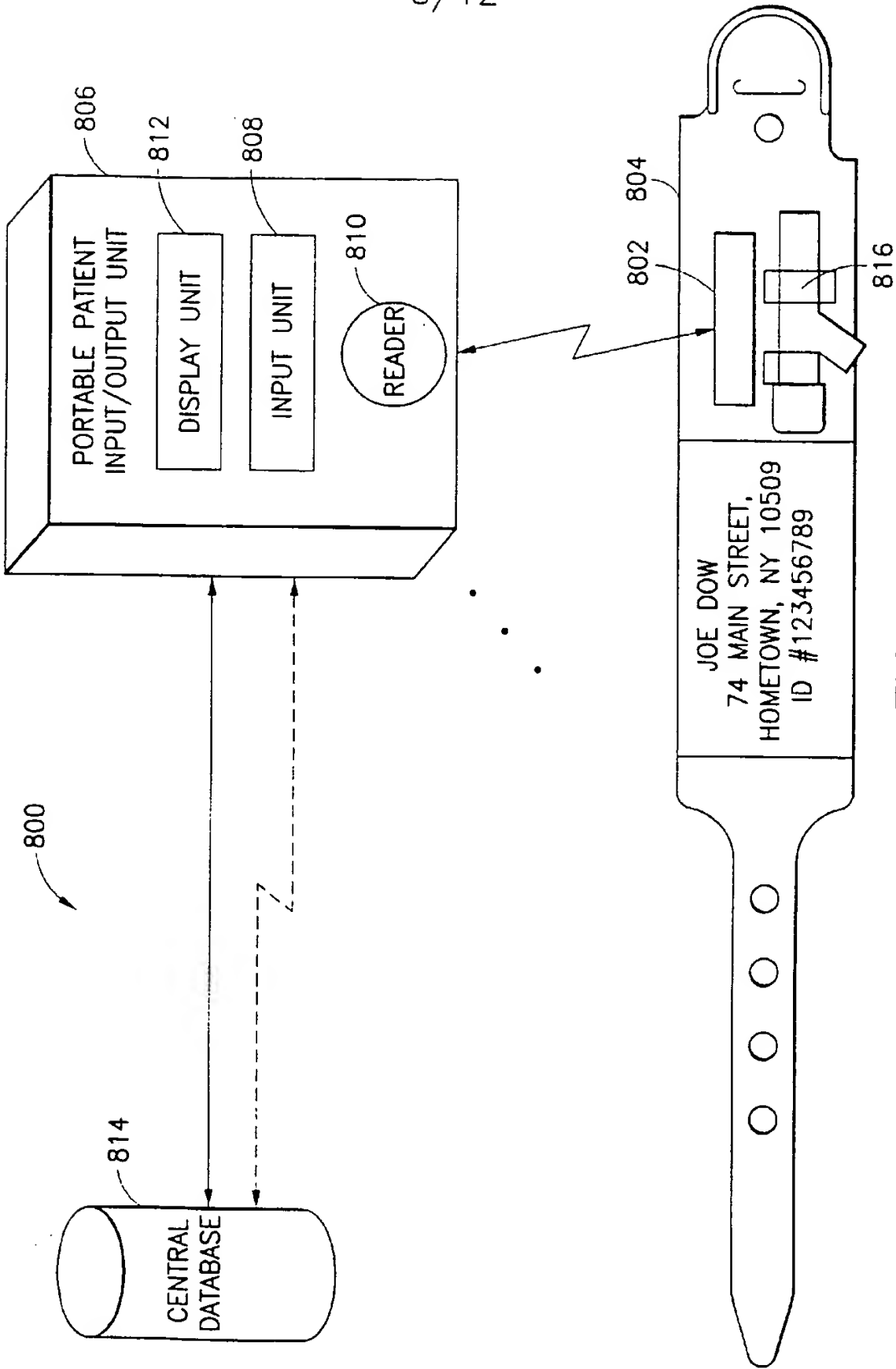


FIG. 8

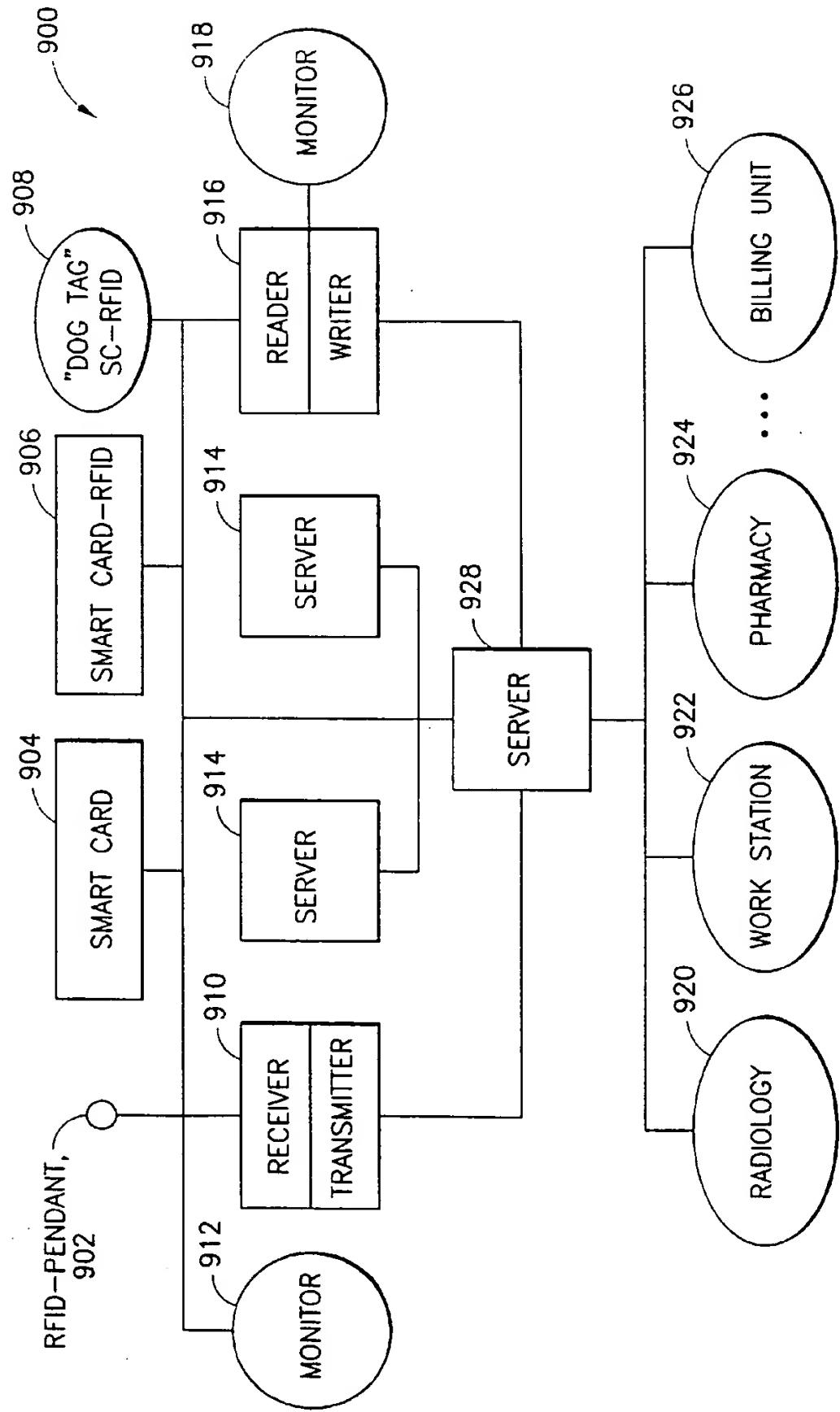


FIG.9

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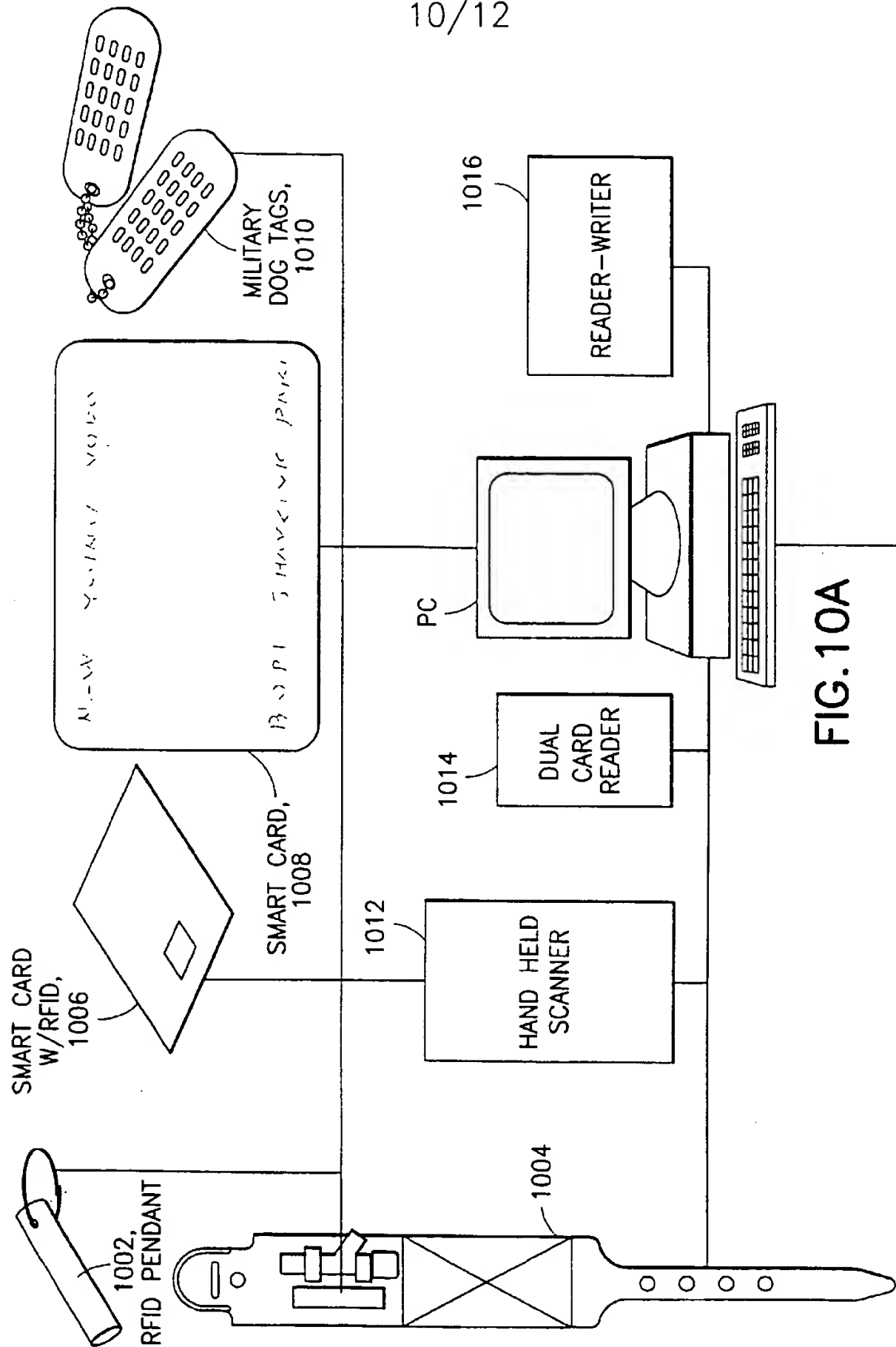


FIG. 10A

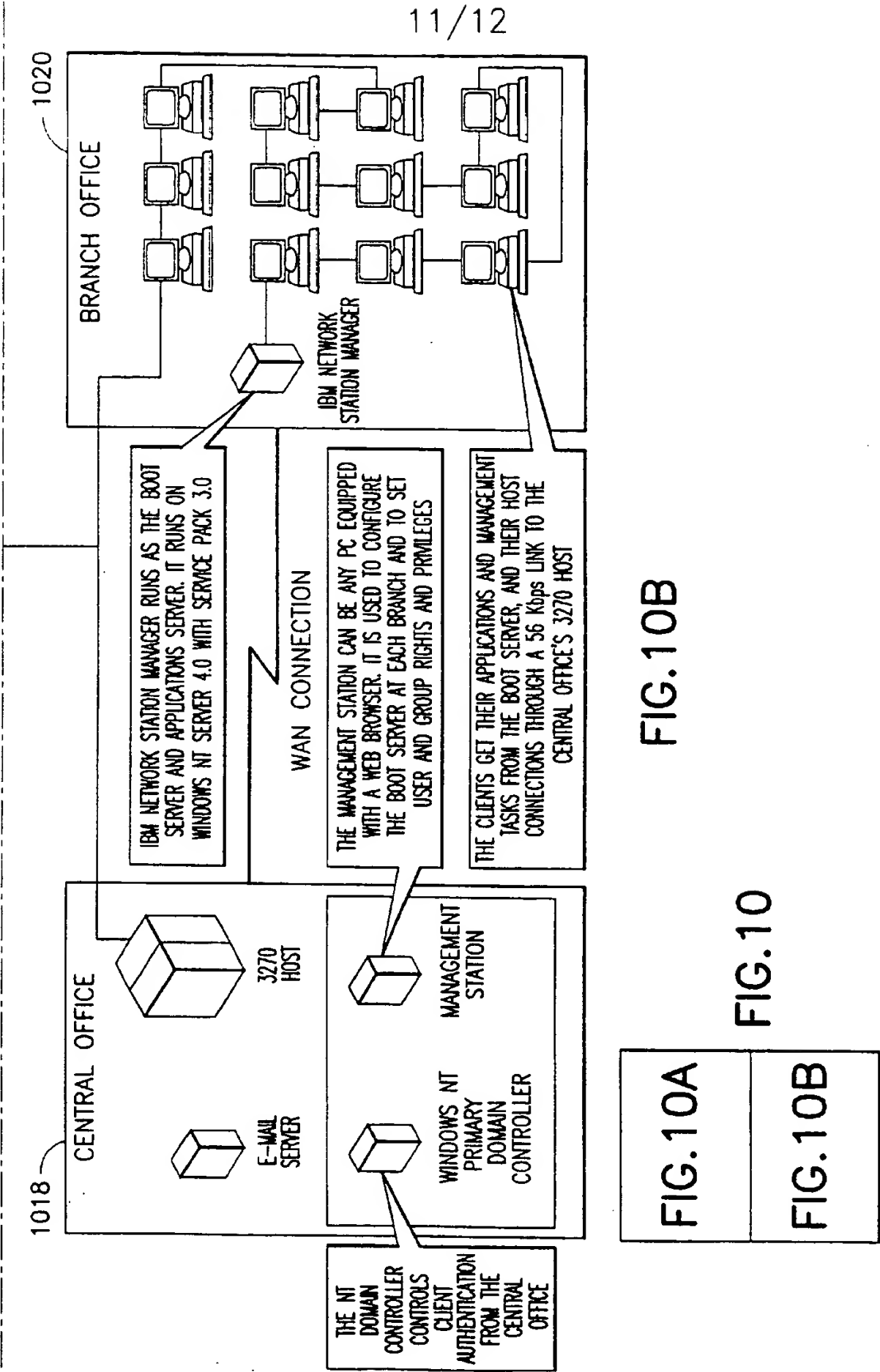
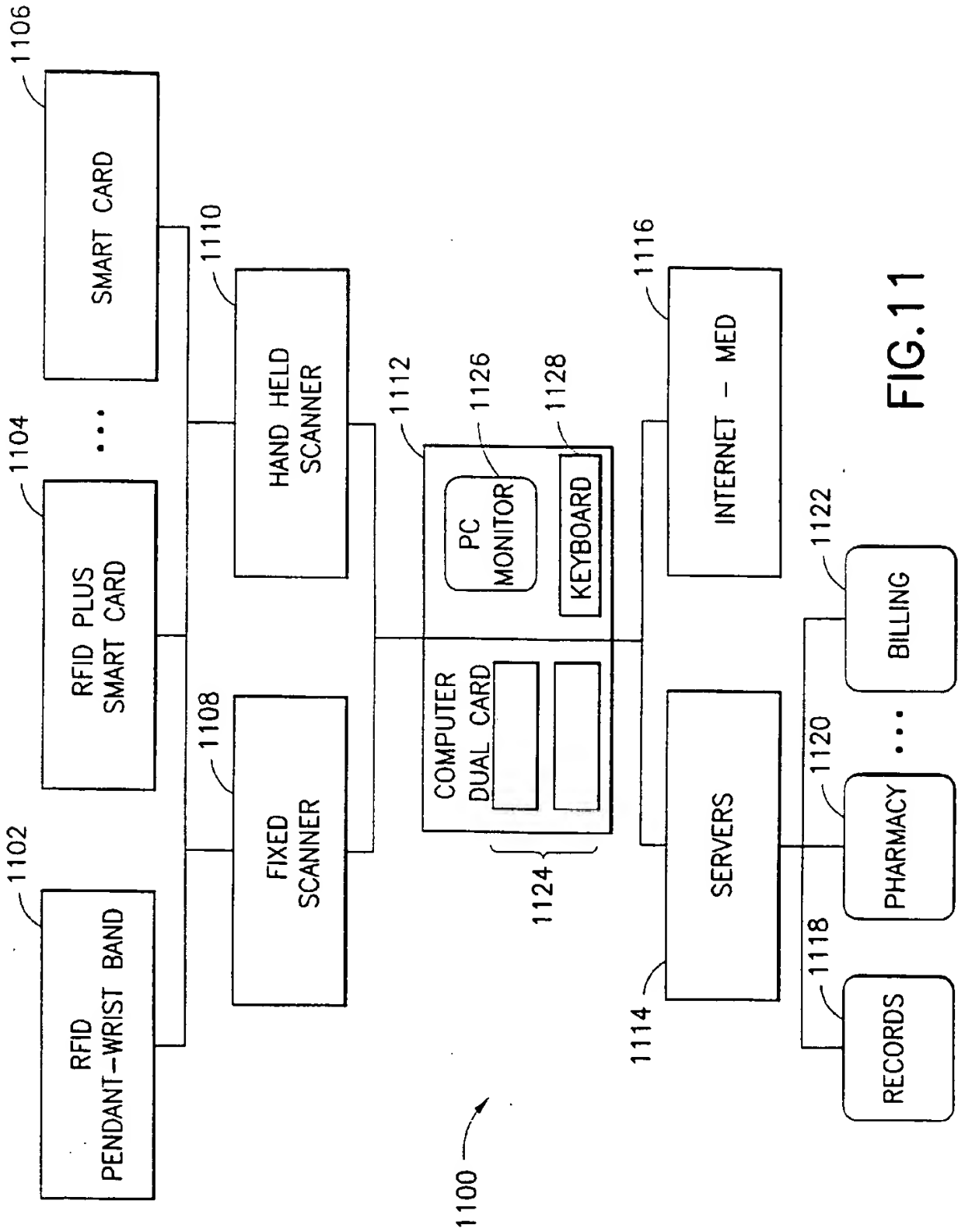


FIG.10A

FIG.10B

FIG.10B

FIG.10



## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US00/01427

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : G06F 19/00  
US CL : 705/2

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 705/2, 3; 235/380

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

STN, DIALOG

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages  | Relevant to claim No. |
|-----------|---|-----------------------|
| X,P       | US 5,995,965 A (EXPERTON) 30 November 1999, abstract, col. 1, lines 10-54, col. 2, lines 42-64, col. 3, lines 13-30, col. 4, lines 1-67 | 1-5,27-31,34-36       |
| X         | US 5,763,862 A (JACHIMOWICZ ET AL) 09 JUNE 1998, COL. 2, LINE 49 - COL. 4, LINE 34  | 27,31                 |
| X,P       | US 5,899,998 A (MCGAULEY ET AL.) 04 MAY 1999, COL. 2, LINE 40 - COL. 3, LINE 60, COL. 5, LINE 50 - COL. 6, LINE 42                      | 1,5                   |
| X         | US 5,499,626 A (WILLHAM ET AL.) 19 MARCH 1996, ABSTRACT, SUMMARY  | 37-38                 |
| Y,P       | US 5,867,821 A (BALLANTYNE ET AL) 02 FEBRUARY 1999, abstract, summary   | 8-20                  |

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

|   |  |
|---|--|
| * Special categories of cited documents:  | *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention  |
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## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US00/01427

| C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT |  |                       |
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| Category*   | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
| Y   | US 5,822,544 A (CHACO ET AL.) 13 OCTOBER 1998, abstract, summary                   | 21-26                 |
| X   | US 5,855,609 A (KNAPP) 05 JANUARY 1999, abstract, figures, summary                 | 37-39                 |
| Y   | US 4,688,026 A (SCRIBNER ET AL) 18 AUGUST 1987 abstract, summary                   | 8-20                  |
| Y,P   | US 5,877,742 A (KLINK) 02 MARCH 1999 abstract, summary                             | 21-26                 |



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